CV SUMMARY – GIANLUCA BARDARO

1. GENERAL INFORMATION

DATE OF BIRTH 16/02/1989

EDUCATION

2020 **PhD Degree** in Information Technology, Politecnico di Milano, Milano (IT).

2014 **Master of Science Degree** in Computer Engineering, Politecnico di Milano, Milano (IT) (110 cum laude/110).

CAREER

2020 – present **Research Associate**, The Open University, Knowledge Media Institute, Milton Keynes (UK)

2019 – 2020 **Research Assistant**, The Open University, Knowledge Media Institute, Milton Keynes (UK)

2017 – 2018 **Visiting Student**, The Open University, Knowledge Media Institute, Milton Keynes (UK)

2015 – 2020 **Ph.D. Student**, Politecnico di Milano, Milano (IT)

2015 – 2015 **Research Assistant** (Assegnista di ricerca), Politecnico di Milano, Milano (IT)

RESEARCH INTERESTS

- **Robotics:** simulation, off-road robots, service robots, control theory
- **Software engineering:** model-based design, code generation, component-based architectures
- **Artificial intelligence:** semantic map, knowledge representation

2. QUALITY OF SCIENTIFIC AND/OR PROJECT PRODUCTION

PRODUCTIVITY AND IMPACT METRICS

- **Scientific Productivity: 24** publications (**18** entries on Scopus, **31** co-authors according to Scopus):
  - Author/Co-author of **2** top ranked **Q1** journal papers based on SCIMAGO (including **International Journal of Social Robotics**, and **Control Engineering Practice**)
  - Author/Co-author of **16** scientific publications on peer-reviewed conferences including **1** top-level **A++/A+ Class 1** conferences according to GII-GRIN-SCIE conf. ranking (including **IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)**)
- **Publication Impact:** Based on Google Scholar: h-index **7** i-10 index **4** citations **120**
  Based on Scopus: h-index **5** citations **58**

TALKS AND SEMINARS

September 2020	"Personal robotic assistants: past, present, and future" at AI and Smart Tech in the Home Organized by Medilink East Midlands (UK)
October 2019	"SciRoc – Lessons learned and what's next" at NatWest Incubator (UK) organized by Milton Keynes AI (MKAI)
May 2019	*"ROS Fundamentals"* at the SemWeb Uitje "Robots, Language and Theory of Mind" organized by VU Amsterdam
July 2017	*"Robot capabilities and models"* at the Knowledge Media Institute
June 2017	*"A Model-Based Approach to Develop Robotics Applications with Component-Based Middlewares"* at the ASTRA conference organized by ESA

COMMISSIONS OF TRUST

2018 – present **Program Committee Member**, IEEE International Conference of Robot Computing

3. TEACHING ACTIVITIES

Institution name	Course name	Credits	Role	Reference Study Course	Time period	Students Evaluation
Politecnico di Milano	Robotics	5	Teaching assistant	Computer Science and Engineering	2016/2017	Medium
Politecnico di Milano	Robotics	5	Teaching assistant	Computer Science and Engineering	2015/2016	Medium

SUPERVISION OF MASTER STUDENTS

2015 – present **Co-advisor** of **4** Master Students in Computer Science and Engineering, Politecnico di Milano, Milano

2018 – present **Co-advisor** of **1** Master Students in Automation and Control Engineering, Politecnico di Milano, Milano

4. PARTICIPATION IN COMPETITIVE RESEARCH PROJECTS

Project Acronym	Time Period	Funding Institution	Funding Scheme	Role of the applicant	Budget for the applicant's institution
REPHE	2021-present	The Open University	RES Innovation Project	Co-investigator	£ 39 867
Gatekeeper	2020-present	European Commission	H2020	Task leader	€ 900 343
SciRoc	2019-2020	European Commission	H2020	Participant	€ 120 000
Plug&Bench	2018-2019	European Commission	H2020 (Cascade funding)	Participant	€ 129 375
Grape	2016-2018	European Commission	FP7 (Cascade funding)	Participant	€ 134 400

5. TWELVE MOST RELEVANT PUBLICATIONS[1]

1. Bardaro, Gianluca, Alessio Antonini, and Enrico Motta. *"Robots for Elderly Care in the Home: A Landscape Analysis and Co-Design Toolkit."* International Journal of Social Robotics (2021): 1-25. https://doi.org/10.1007/s12369-021-00816-3 **SJR: Q1**

   I am one of the main contributors of the paper. I wrote the survey on previous healthcare robots and provided the robotics background to create the co-design toolkit. I also handled the review and rebuttal process.

2. Chiatti, Agnese, Gianluca Bardaro, Emanuele Bastianelli, Ilaria Tiddi, Prasenjit Mitra, and Enrico Motta. *"Task-agnostic object recognition for mobile robots through few-shot image matching."* Electronics 9, no. 3 (2020): 380. https://doi.org/10.3390/electronics9030380 **SJR: Q2**

   I designed and developed the architecture of the autonomous robot used in this work. Moreover, I provided support in the data collection, data preparation and experimental phases. I also contributed to the review and rebuttal process.

3. Bardaro, Gianluca, Andrea Semprebon, Agnese Chiatti, and Matteo Matteucci. *"From Models to Software Through Automatic Transformations: An AADL to ROS End-to-End Toolchain."* In

[1] For journal paper the Scimago Journal & Country Rank (SJR) quartiles is reported. For conference papers the class from the GII-GRIN-SCIE Rating is reported.

2019 Third IEEE International Conference on Robotic Computing (IRC), pp. 580-585. IEEE, 2019. https://doi.org/10.1109/IRC.2019.00118

I am the main contributor of this paper. The toolchain presented in this work is one of the outputs of my PhD thesis: an automatic process to generate ROS code from models. Moreover, I co-supervised the master student co-author of this paper.

4. Bardaro, Gianluca, Mohamed El-Shamouly, Giulio Fontana, Ramez Awad, and Matteo Matteucci. *"Toward model-based benchmarking of robot components."* In 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 1682-1687. IEEE, 2019. https://doi.org/10.1109/IROS40897.2019.8967682 **GII-GRIN-SCIE Class 1 (A+)**

   I am one of the main contributors of the paper. I developed the use cases presented in the manuscript. The main idea of this work is an extension of the model-based approach developed during my PhD applied to benchmarking of robot components.

5. Bardaro, Gianluca, Luca Bascetta, Eugenio Ceravolo, Marcello Farina, Mauro Gabellone, and Matteo Matteucci. *"MPC-based control architecture of an autonomous wheelchair for indoor environments."* Control Engineering Practice 78 (2018): 160-174. https://doi.org/10.1016/j.conengprac.2018.06.020 **SJR Q1**

   I designed and developed the architecture of the autonomous wheelchair used in this work. I also performed most of the experiment presented. Additionally, I developed the ROS-compatible MPC plugin that controlled the wheelchair.

6. Bardaro, Gianluca, Andrea Semprebon, and Matteo Matteucci. *"A use case in model-based robot development using AADL and ROS."* In Proceedings of the 1st International Workshop on Robotics Software Engineering, pp. 9-16. 2018 https://doi.org/10.1145/3196558.3196560

   I am the main contributor of this paper. The use case presented in this work is one of the outputs of my PhD thesis: a complete robot architecture developed using a model-based approach. Moreover, I co-supervised the master student co-author of this paper.

7. Tiddi, Ilaria, Emanuele Bastianelli, Gianluca Bardaro, and Enrico Motta. *"A User-friendly Interface to Control ROS Robotic Platforms."* In International Semantic Web Conference (P&D/Industry/BlueSky). 2018. http://ceur-ws.org/Vol-2180/paper-70.pdf

   This is an interdisciplinary work between semantic technologies and robotics. I designed and developed the architecture of the robots used in this paper. Additionally, I developed the abstraction layer between the robot and the web interface. I also contributed to the writing and review process.

8. Bardaro, Gianluca, and Matteo Matteucci. *"Using AADL to model and develop ROS-based robotic application."* In 2017 First IEEE International Conference on Robotic Computing (IRC), pp. 204-207. IEEE, 2017. https://doi.org/10.1109/IRC.2017.59

   I am the main contributor of this paper. The use of AADL to create models of robotic components as presented in this work is the foundation and one of the key elements of my PhD.

9. Tiddi, Ilaria, Emanuele Bastianelli, Gianluca Bardaro, Mathieu d'Aquin, and Enrico Motta. *"An ontology-based approach to improve the accessibility of ROS-based robotic systems."* In Proceedings of the Knowledge Capture Conference, pp. 1-8. 2017. https://doi.org/10.1145/3148011.3148014 **GII-GRIN-SCIE Class 3 (B)**

   This is an interdisciplinary work between semantic technologies and robotics. In this work, an ontology is presented to define high-level robotic capabilities. I provided the necessary robotic background to support the definition of these capabilities. I also contributed to the writing and review process.

10. Roure, Ferran, Germán Moreno, Marcel Soler, Davide Faconti, Daniel Serrano, Pietro Astolfi, Gianluca Bardaro, Alessandro Gabrielli, Luca Bascetta, and Matteo Matteucci. *"GRAPE: Ground Robot for vineyArd Monitoring and ProtEction."* In Iberian Robotics Conference, pp. 249-260. Springer, Cham, 2017. https://doi.org/10.1007/978-3-319-70833-1_21

    I provided direct support during field activities and the experimental phases of this work. In

particular in the implementation and configuration of mapping and navigation functionalities. Moreover, I co-supervised the master student co-author of this paper.

11. Bardaro, Gianluca, Luca Bascetta, Francesco Casella, and Matteo Matteucci. *"Advancement in multi-body physics modeling for 3d graphical robot simulators."* In International Workshop on Modelling and Simulation for Autonomous Systems, pp. 189-195. Springer, Cham, 2016. https://doi.org/10.1007/978-3-319-47605-6_15

    I am one of the main contributors of the paper. I developed the software that implements the bridge between the 3D graphical simulator (i.e., Gazebo) and a Modelica-based simulator. I also contributed to the writing and review process.

12. Bardaro, Gianluca, Davide Antonio Cucci, Luca Bascetta, and Matteo Matteucci. *"A simulation based architecture for the development of an autonomous all terrain vehicle."* In International conference on Simulation, Modeling, and Programming for Autonomous Robots, pp. 74-85. Springer, Cham, 2014. https://doi.org/10.1007/978-3-319-11900-7_7

    I am the main contributor of this paper. I designed and developed the model of the simulated robot, the software architecture controlling the autonomous all-terrain vehicle and the seamless bridge between the simulation and the control system.

6. LIST OF THREE PEERS WHO COULD PROVIDE A REFERENCE LETTER

PROF. ENRICO MOTTA - Full Professor of Knowledge Technologies, Knowledge Media Institute, The Open University (Milton Keynes, UK). enrico.motta@open.ac.uk

DR. ILARIA TIDDI - Assistant Professor, Faculty of Science, Vrije Universiteit Amsterdam (Amsterdam, NL). i.tiddi@vu.nl

DR. DAVIDE CUCCI - Senior Research Associate, Research Centre for Statistics, Université de Genève (Geneva, CH). davide.cucci@unige.ch

RESEARCH STATEMENT: *Full statement here*

TEACHING STATEMENT: *Full statement here*

Gianluca Bardaro

Curriculum Vitae

Name: Gianluca Bardaro
Date of Birth 16/02/1989
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Address: Walton Hall, Milton Keynes MK7 6AA (UK)
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H-index / i10-index / Citations:
7/ 4 / 120 (source: Google scholar)
5 / - / 58 (source: Scopus)

SHORT BIO

Gianluca Bardaro is a Research Associate at the Knowledge Media Institute of the Open University (Milton Keynes, UK). He started his educational path at Politecnico di Milano, where, in 2012, he got a bachelor's degree in Computer Engineering. Later, in 2014, he received a master's degree cum laude in Computer Engineering. His interest in robotics started during his master thesis where he developed the software architecture and simulation of an off-road autonomous vehicle. After a brief period as a Research Assistant, he started his PhD in 2015. Building on top of the knowledge collected during his pervious experiences, the central topic of his PhD was the design and development of patterns, tools, and techniques to simplify and enhance the development process of software components for robotics. While working on his PhD, he completed two visiting periods at the Knowledge Media Institute (The Open University, UK). During these visits he explored how semantic technologies could be used to create an abstraction layer between the low-level functionalities of a robot and the high-level capabilities required by high-level applications. Moreover, during his PhD, he took part in different EU-funded projects, such as GRAPE (Ground Robot for vineyArd monitoring and ProtEction), with the aim of developing an unmanned ground vehicle to support work in vineyards, and Plug & Bench, a cascade funding from the RobMoSys project aimed at developing a reusable and composable benchmark for robotic components. Moreover, while finalising his PhD thesis, he worked as a Research Assistant the Knowledge Media Institute. His main task was the organisation of the 2019 edition of SciRoc (Smart City and Robotic Challenge), that took place in Milton Keynes and involved ten international teams competing in five different challenges about the interaction between robots and smart cities. In 2020, he obtained his PhD in Information Technology from the Politecnico di Milano. His PhD Thesis reflects his interdisciplinary experience over the previous four years and integrates different approaches that different domain experts can use to streamline the development process of robotic components. These methods include, for instance, model-based design, automatic code generation, and ontology-based abstractions. Currently, he is one of the task leaders of the GATEKEEPER project. The objective of the task which he is leading is the development of a robotic assistant that is integrated in a larger smart ecosystem and supports older adults in their daily activities. In 2021, he also led a joint team between The Open University (UK) and Politecnico di Milano (IT) to take part to the 2021 edition of the SciRoc Competition. His team won the first prize in the "Shopping Cart" episode.

EDUCATION

2015 – 2020	**PhD in Information Technology** at Politecnico di Milano, Milan (IT) (13/03/2020). Thesis: "Models, code generation, and abstraction: a triple approach to enhance robot software development". Advisor: Prof. Matteo Matteucci
2012 – 2014	**Master's degree in Computer Engineering** at Politecnico di Milano, Milan (IT) (03/10/2014). Thesis: "High level control architecture and dynamic simulation for an autonomous all terrain robot". Advisor: Prof. Matteo Matteucci
2008 – 2012	**Bachelor's degree in Computer Engineering** at Politecnico di Milano, Milan (IT) (27/02/2012)

ACADEMIC CAREER

2020 – present	**Research Associate**, The Open University, Knowledge Media Institute, Milton Keynes (UK)
2019 – 2020	**Research Assistant**, The Open University, Knowledge Media Institute, Milton Keynes (UK)
2017 – 2018	**Visiting Student**, The Open University, Knowledge Media Institute, Milton Keynes (UK)
2015 – 2020	**Ph.D. Student**, Politecnico di Milano, Milano (IT)
2015 – 2015	**Research Assistant** (Assegnista di ricerca), Politecnico di Milano, Milano (IT)

TEACHING

2015 – 2017	**Teaching Assistant** for the "Robotics" course of the Computer Engineering degree, Politecnico di Milano

STUDENTS SUPERVISION

Master Thesis

19/04/2018	Carolina Arauz Villegas Thesis in Automation and Control Engineering at Politecnico di Milano "Implementation, comparison, and advances in global planners using Ackerman motion primitives"
19/04/2018	Giovanni Beri Thesis in Computer Science and Engineering at Politecnico di Milano "Design, development, and deployment of a mobile manipulator for vineyard monitoring and protection"
21/12/2017	Andrea Semprebon Thesis in Computer Science and Engineering at Politecnico di Milano "Model based robot development: from AADL to ROS through code generation"
21/12/2017	Fabio Venuto Thesis in Computer Science and Engineering at Politecnico di Milano "An experiment in autonomous navigation for a security robot"
03/10/2017	Pietro Astolfi Theis in Computer Science and Engineering at Politecnico di Milano "An experiment in autonomous vineyard navigation: the GRAPE project"

Other Activities

Summer 2021	Filippo Betti, Chiara Bigi, and Stefano Gatti Team Hybots for SciRoc 2021 Joint team from The Open University and Politecnico di Milano Winner of “Episode 3 – Shopping Cart”
Summer 2021	Kaushal Kumar Black, Asian, and minority ethnic (BAME) scholarship at The Open University

RESEARCH PROJECTS

Robot Embodied Presence in House Environment (REPHE)

REPHE is a project funded by The Open University through the “RES Innovation Projects Guidance and Application” scheme. The objective of this scheme is to support academics in collaborative projects with external partners that transfer research into innovations that solve commercial challenges. In particular, REPHE is a partnership between the Knowledge Media Institute (The Open University) and Extend Robotics. Extend Robotics is an UK company that developed a system based on virtual reality (VR) to remotely control robot manipulators. As The Open University, we will extend the tools already developed by Extend Robotics to support mobile manipulators, such as PAL Robotic Tiago. Additionally, we will co-develop a system based on augmented reality (AR) to support telepresence through smartphones.

Gatekeeper

Gatekeeper is a flagship Horizon 2020 project aimed at supporting healthy and independent living for the ageing populations with the application of advanced Information and Communications Technologies. It is a multi-centric large-scale pilot on smart living environments aimed at creating a platform to connect the multiple actors involved in the healthcare system (e.g., medical professionals, informal carer, patients, etc.) and use it to generate and share novel ideas, technologies, and solutions. As The Open University, we are in charge of the large-scale pilot (~5000 participants) in Milton Keynes (UK). As task leader, I oversee the design and development of an in-house robotic assistant. The robot, based on the commercial platform Tiago by PAL Robotics, will be able to interact with the larger ecosystem of the smart house and perform many actions to support the user. The main functionalities of the robot are telepresence, human activity recognition, object identification and classification, manipulation and grasping.

Smart Cities and Robotic Challenge (SciRoc)

The Smart Cities and Robotic Challenge is a Horizon 2020 project aimed at organising robotic competitions in the context of the European Robotics League (ERL). In particular, the objective is to facilitate the integration of smart cities and robotics through a series of competitions on the topic. As the Open University, we were in charge of organising the first edition of the SciRoc competition, a biennial event where the multiple aspects of ERL come together in a single showcase. The 2019 edition of SciRoc was unique in many ways: various challenges coexisted in a single space, the general public was directly involved in the competition, and the interaction with the smart city was intertwined with the robotic tasks. My role was to oversee the organisation of the competition, the definition of the competition rules, and the recruitment and management of the teams. Additionally, to support the event, we developed a system to simulate the interaction between the robot involved in the competition and a hypothetical smart city.

Plug & Bench (RobMoSys)

Plug & Bench was a cascade funding project within the Horizon 2020 project RobMoSys. The aim of RobMoSys was to support model-based development for robotics. In this context, Plug & Bench produced a standardised and composable performance benchmark for robotic components. By exploiting the meta-model defined by RobMoSys, we defined a generalised benchmark model, that can be used to design component benchmarks. My role was the development of the demonstrator used as a proof of concept of this system.

Ground robot for vineyard monitoring and protection (GRAPE)

GRAPE was a cascade funding project withing the FP7 project ECHORD++. The objective of the project was the development of an unmanned ground robot equipped with a manipulator to perform semi-autonomous monitoring of a vineyard and the autonomous placement of pheromones to combat pests. In this project, I provided support during the field experiments by assisting in the development and configuration of the mapping and navigation components.

Invited Talks

September 2020	"Personal robotic assistants: past, present, and future" at AI and Smart Tech in the Home organised by Medilink East Midlands (UK)
October 2019	"SciRoc – Lessons learned and what's next" at NatWest Incubator (UK) organised by Milton Keynes AI (MKAI)
May 2019	"ROS Fundamentals" at SemWeb Uitje "Robots, Language and Theory of Mind" organised by Vrije Universiteit Amsterdam (NL)
July 2017	"Robot capabilities and models" at Knowledge Media Institute, The Open University (UK)
June 2017	"A Model-Based Approach to Develop Robotics Applications with Component-Based Middlewares" at ASTRA conference organised by European Space Agency (ESA)

Research Statement

Ongoing research and achievements

Since the beginning of my PhD, I have worked under the hypothesis that robotic platforms (i.e., the collection of sensors and actuators) are becoming more accessible and advanced, while robotic applications (i.e., the software components executed) are lagging behind. Nowadays, this hypothesis is confirmed when comparing the commercially available platforms against the applications. Hardware-wise we have access to drones and legged robots, while software-wise the most common robot is still an autonomous vacuum cleaner. However, the issue is not in the development of the single functionalities, but in their integration and concertation. My PhD had the aim of creating tools, design patterns, and techniques to support software development for robotics. The result was a modelling paradigm for robotics based on AADL with an associated code generator to streamline the development process. The modelling approach was created to support the component development and architectural analysis phases. While some of the proposed designs are now part of ROS2, the architectural aspects are still in need of adoption. Following this assumption, during my visiting at the Knowledge

Media Institute, I explored the use of semantic web technologies and data science to create an abstraction layer between the robotic platform and the application, to make robotics more accessible to non-expert. This innovative pairing (i.e., robotics and semantic web technologies) allowed us to successfully prototype a system that can control and program a robot using an ontology to describe the robot capabilities and various APIs for interaction. Similarly, data science is another field that robotics can use to its advantage. Robots are, basically, a collection of sensors and actuators, and produce a significant amount of data that can be useful to debug, understand, and explain their behaviours. In this context, during the SciRoc competition, I have developed an interface that a robot can use to share, catalogue, and store the data produced to a centralised data hub. This system was also crucial to successfully engage the general public during the competition. Currently, I am working on the development of a robotic in-house assistant for elderly care. Given the breadth of this application, I am applying many of the design concept and technologies I have developed in previous years. These include, for instance: the decomposition of the robot functionalities in capabilities, the architecture-oriented design, and the data storage and management techniques. In particular, I am currently working on the concept of a 3D semantic map. A 3D semantic map is a collection of all the measurements, processing, and activities generated by the robot that can be described in a spatial-temporal context. Examples of the type of data represented in a semantic map are the robot position, the objects through its camera sensors, the user information collected, and the robot future behaviour. All this information is associated with a timestamp and lose validity with the passing of time. Therefore, this representation provides an up-to-date view of the environment, which the robot can use to plan its actions. Since the semantic map is implemented using a GIS database, it can also be used as an agnostic data exchange layer between the robot and other external systems.

Short-term research directions

Most recently, ROS2 has expedited the advancement of software engineering for robotics. The design and development of components is indeed more structured and modular, and the framework supports and encourages good practices. However, from the architectural point of view, there are still significant gaps. For example, there is no overarching view of the architecture during the development phase, no tool to estimate the error propagation between components, no formal analysis of the expected behaviour, and no standard for benchmarking. While this seems an engineering matter instead of a research problem, many of these are unique in the context of robotics because of the nature of a robot as an interconnected system of systems and the impact of the real world in the execution loop.

Taking into account the real world can generate many research problems. First of all, providing an abstraction that the robot can use during execution is a challenge. To tackle this problem, the aforementioned 3D semantic map could be further extended. For example, one could add: a stronger concept of time to track the evolution of the environment, object anchoring mechanisms to aggregate multiple measurements, and a more detailed semantic labelling to assist the robot in its activities. Moreover, a faithful representation of the real world (i.e., a simulation) is a useful tool during development and testing. Currently, in robotics, there is a strong dichotomy regarding simulators. On the one hand, 3D graphical simulators support all robot sensors and human-in-the-loop features but have a simplified physics simulation. On the other hand, simulators for dynamic systems have a very precise and reliable physics simulation and can handle high complexity, but only support batch simulation (i.e., no human interaction) and struggle in simulating many robot sensors. The integration of these two different types of simulators is an open research problem that I only partially explored in the

early stages of my PhD. When integrated, they can support the design and development of robots working in complex environments (e.g., in the mud, on rocks, in the snow, etc.) or with a more complex dynamics (e.g., Ackermann, legged robots, etc.).

Currently, I am working on an in-house robotics assistant, which is mainly a huge integration effort of existing technologies. During the development process I realised how many state-of-the-art AI solutions are unsuitable for robotics. Human activity recognition, object detection and classification, semantic segmentation, speech recognition and dialogue, and face recognition are all functionalities that had a breakthrough in recent years thanks to the advancement of deep learning. However, to achieve acceptable results, it is necessary to have available a significant amount of computational power. This is often unobtainable in robotics. In some cases, it is possible to exploit the resources of external servers, but often robots work in conditions that requires them to be self-contained. To overcome these limitations, I have successfully used an edge TPU (tensor processing unit) to run some of these functionalities directly on the robot. The use of this specialised hardware and the adaptation of state-of-the-art algorithms to be used on edge TPUs are both very interesting topics that should be explored more in robotics.

Finally, my experience in service robotics, and in particular in the context of robots conceived for older adults, has consolidated the view that robots are still uncapable of dealing with environments as complex as the household. Industrial robots are widely used and well established, while service robots are rarely deployed in real-world scenarios. I believe that a steppingstone between the well-defined and structured environment of a factory and the unstructured and unpredictable environment of the house is needed. Agricultural robotics can provide this connection. Agricultural fields are partially structured: for example, their layout does not change over time. However, managing the crops requires to handle complex and unpredictable environmental conditions, such as lighting and weather variations. Moreover, investing in agricultural robotics is also an ethical and environmental choice, since in this sector human workers are often exploited and underpaid and pesticides and herbicides are overused to compensate for the lack of cheap labour.

Teaching Statement

I view teaching as a core academic activity, and, in my career, I have enjoyed my teaching assistant duties. As a teaching assistant of the Robotics course, I have been very involved in the teaching process, since I have also designed all the material that was (and still is) used to support the lectures. Given this experience and my research field, Robotics is the topic that I am more interested in teaching. I would put the focus on the elements that are recurring in all types of robots, such as sensors and actuators, and on how the input received by the sensors is transformed into actions (i.e., planning). I would also try to give the students an idea of what is the state-of-the-art in term of applications in robotics, to make them more aware of the challenges in this field.

In my career, I have had the opportunity to work with a wide variety of programming languages (e.g., C++, Python, Lua, C#, Ada), as well as with many different design paradigms. My programming experience has taught me how languages and paradigms are like tools in a toolbox. Moreover, I have also learned the importance of using the right tool for the right problem. I think this is a key skill to have, especially for a computer engineer. Therefore, I would like to share this knowledge with other people and train them on selecting the right language and paradigm for the problem at hand.

Lastly, I have worked on various type of simulators, and I think they are one of the most important tools any engineer can use. The best way to understand a phenomenon is to see it in action. Hence, whenever direct experimental activity is impossible, simulations are the answer. Additionally, simulations can be used to appreciate how changing the involved parameters will impact the behaviour of the system. In this context, I would like to teach students the different types of simulators that exist, how to setup a simulated environment, how to run and interact with the simulation, and how to adjust it to fit the phenomenon under analysis.

PUBLICATIONS[2]

Journals

Bardaro, Gianluca, Alessio Antonini, and Enrico Motta. "Robots for Elderly Care in the Home: A Landscape Analysis and Co-Design Toolkit." International Journal of Social Robotics (2021) **SJR: Q1**

Chiatti, Agnese, Gianluca Bardaro, Emanuele Bastianelli, Ilaria Tiddi, Prasenjit Mitra, and Enrico Motta. "Task-agnostic object recognition for mobile robots through few-shot image matching." Electronics 9, no. 3 (2020) **SJR: Q2**

Bardaro, Gianluca, Luca Bascetta, Eugenio Ceravolo, Marcello Farina, Mauro Gabellone, and Matteo Matteucci. "MPC-based control architecture of an autonomous wheelchair for indoor environments." Control Engineering Practice 78 (2018) **SJR: Q1**

International Conferences and Workshops

Bardaro, Gianluca, Mohamed El-Shamouly, Giulio Fontana, Ramez Awad, and Matteo Matteucci. "Toward model-based benchmarking of robot components." In *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 1682-1687. IEEE, 2019. **GII-GRIN-SCIE Class 1 (A+)**

Bardaro, Gianluca, Andrea Semprebon, Agnese Chiatti, and Matteo Matteucci. "From Models to Software Through Automatic Transformations: An AADL to ROS End-to-End Toolchain." In *2019 Third IEEE International Conference on Robotic Computing (IRC)*, pp. 580-585. IEEE, 2019.

Bardaro, Gianluca, Danilo Dessì, Enrico Motta, Francesco Osborne, and Diego Reforgiato Recupero. "Parsing Natural Language Sentences into Robot Actions." In *ISWC Satellites*, pp. 93-96. 2019.

Chiatti, Agnese, Gianluca Bardaro, Emanuele Bastianelli, Ilaria Tiddi, Prasenjit Mitra, and Enrico Motta. "Exploring task-agnostic, ShapeNet-based object recognition for mobile robots." In Data Analytics solutions for Real-LIfe Applications (DARLI-AP). 2019.

Bastianelli, Emanuele, Gianluca Bardaro, Ilaria Tiddi, and Enrico Motta. "Meet HanS, the Heath & Safety Autonomous Inspector." In *International Semantic Web Conference (P&D/Industry/BlueSky)*. 2018.

Bardaro, Gianluca, Andrea Semprebon, and Matteo Matteucci. "A use case in model-based robot development using AADL and ROS." In Proceedings of the 1st International Workshop on Robotics Software Engineering, pp. 9-16. 2018.

Tiddi, Ilaria, Emanuele Bastianelli, Gianluca Bardaro, and Enrico Motta. "A User-friendly Interface to Control ROS Robotic Platforms." In International Semantic Web Conference (P&D/Industry/BlueSky). 2018.

[2] For journal paper the Scimago Journal & Country Rank (SJR) quartiles is reported. For conference papers the class from the GII-GRIN-SCIE Rating is reported.

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